CHAPTER 6

SHOULDERS AND ROADSIDES

6-1. Shoulders

Shoulders serve as safety strips for emergency use or for temporary parking of vehicles. They provide lateral support for pavements and protect their edges from raveling, undermining, abrading, and breaking. As elements of surface drainage systems, they also convey storm runoff from the edge of the pavement to ditches, inlets, or natural watercourses. Roadsides are areas beyond the shoulders which affect the safety or structural performance of pavements.

6-2. Types of shoulder surfaces

Shoulders may have earth, stabilized, or treated surfaces. Material used is generally of lower quality than that used for the adjacent pavement. Shoulders will have the stability necessary to support traffic in emergencies and will resist washing and displacement without excessive maintenance. Contrast in color or surface texture is desirable to discourage use of shoulders as a traveled way.

a. Earth. Native soil, unstabilized or without turf cover, is generally unsatisfactory as a permanent shoulder material. Fine-grained soils are too soft when wet, and sandy materials are too unstable when dry for use by traffic in emergencies. Where soil is naturally well-graded and rainfall is low, earth shoulders are satisfactory for pavements carrying light traffic.

b. Sod. Sodded or turfed shoulders are superior to earth and will be developed and maintained wherever climatic, soil, or traffic conditions permit. They are unsuitable and costly to maintain along heavily traveled narrow pavements, at sharp turns, or in congested areas where traffic repeatedly used the shoulder. Since turf increases the height of the shoulders, the surface will be cut down before seeding.

c. Soil aggregate. Where higher stability is required, existing soil will be blended with aggregate, or imported material will be placed to provide a soil-aggregate shoulder surface. Aggregates will be pit-run, graded or processed materials (including gravel, stone, slag, chats, mine tailings, talus rock, scoria, coral, shell, iron ore, chert, shale, caliche, cinders), or sand-clay. Well-graded crushed stone produces the most desirable shoulder material. Depth of the shoulder material should be 4 to 6 inches depending on the depth of the adjacent pavement structure. Material should not exceed 1 inch in size or grades under 5 percent. On steeper grades, a coarser material will be used. But, it will be of such character as to remain in place during adverse environmental periods. Also, it will be easily compacted.

d. Bituminous. Bituminous-surfaced shoulders will be provided where complete dust control and maximum safety are required. With this type of shoulder, stability and control of erosion are also improved. Bituminous shoulders will be generally used only along high-quality pavements, on airfields, and on roads which carry a large volume of traffic.

e. Dual type. Road shoulders are sometimes partially paved, particularly along narrow pavements, inside curves, and at intersections or turnouts. The shoulder area adjacent to the pavement will be stabilized by surfacing with soil-aggregate or bituminous material; the outer portion will be earth or sod. Where porous aggregates are used for shoulder construction, care will be taken to ensure that adequate provisions for drainage are made and maintained.

6-3. Geometrics

General geometric information on shoulders is available in the following paragraphs.

a. Slope. Shoulders will be maintained such that they are flush with or slightly below the edge of pavement and slope away from it. The only exception will be along the high side of pavements that are designed for drainage in a single direction. Criteria governing cross slope include class of road, safety requirements, and the necessity for obtaining positive runoff of surface waters. Steeper slopes will be required for roads and walks on steep grades and at the foot of hills to minimize longitudinal flow of water or pavement ponding.

b. Width. The minimum desirable width of road shoulders for light traffic is 4 feet. For high-speed traffic and where vehicles may have to park clear of pavement, the minimum desirable width is 10 feet. Shoulder widths for airfield pavements vary according to class of airfield and specific design.

c. Shape. The outer edges of road and walk shoulders will be rounded. This section is economical, more easily maintained, and much safer than the abrupt type.

6-4. Types and causes of shoulder distress

a. Erosion. Erosion is the removal of material by either wind or water. Erosion is a major problem on untreated shoulders. When water is not adequately dispersed, erosion will take place even where sod has been placed.

b. Rutting. Rutting from traffic is a severe problem with earth shoulders and is one of the basic reasons for the low utilization of this type of shoulder. The rutting potential will be greatest when the shoulders are in a saturated condition.

c. Water intrusion. Water intrusion will cause damage to the shoulders by weakening the subgrade. Water will enter either by penetrating the surface or by percolating up from underneath. The damage caused by the water will depend on the type of material which makes up the shoulder.

d. Slips and slides. A slip or slipout is a slope movement or failure that occurs because of a subsurface fault of slipping plane. A slide is a sloughing or collapse of a slope. Both types of failure can obstruct or cover pavements and drainage facilities. A slip is caused most commonly by movement of an earth mass down an inclined plane lubricated by seepage of storm runoff or by ground water. The plane is usually the surface of an impervious soil or rock layer where ground water is collected and trapped. Slides result from construction of steep cut or fill slopes. Slides are also caused by washing or saturation of the slope by surface or ground water, frost action, weathering, vibration from blasting, excavation at toe of slope, overloading at top of slope, or other mechanical disturbances.

e. Settlement. A settlement is a downward movement of a section of the shoulder. The settlement is normally caused by insufficient compaction during construction.

6-5. Methods of shoulder repair

Shoulders will be maintained with a tight smooth surface flush with or slightly below adjoining pavements to correct slope, width, and section. Maintenance and repair methods differ according to type of shoulder surface but generally involve leveling of ruts and washes, filling of low areas, and cutting down high areas to proper grade and slope. Shoulders will be maintained primarily to protect the basic pavement structure, eliminate traffic hazards, and ensure proper drainage. Protection of pavement edges is essential and is assured if proper maintenance practices are followed. During blading and dressing of shoulders, materials will be distributed evenly over the shoulders and not left as a ridge along the pavement. Where soil erodes easily, fills will be protected by placing a small dike at the shoulder edge with openings placed at specified intervals. This practice will confine surface water to designated areas where a paved or sod flume can be provided.

a. Equipment. General light earth-moving equipment will be adequate for all repairs. A grader is useful for removing deformations and properly shaping the shoulders.

b. Repair methods. A large part of repairing shoulders and roadsides involved correcting problems with drainage which has often caused the problem. Chapter 7 contains more detailed information on repair methods in regards to drainage.

(1) *Dikes, flumes, and culverts*. Dikes, flumes, and culverts will be used to intercept and divert surface water. These structures will be inspected for any breaks, cracks, or joints. These structures must be kept free from debris or anything which would inhibit flow.

(2) *Piling, cribbing, and retaining walls.* Piling, cribbing, and retaining walls are necessary where shoulders are placed near steep slopes that must be stabilized. The use of each method is dependent on the particular requirements which arise. For the retaining walls, the weep holes for drainage from behind the walls will be inspected and cleaned or replaced if they become clogged. All structures should be repaired or replaced if they are damaged.

(3) *Sodding and seeding.* Heavy sod will be developed as close to the edge of pavement as possible. Dense sod will not be disturbed on self-draining areas. Damaged areas should be filled with pulverized soils to 3 inches below surface of pavement. New sod of proper thickness should be placed and tamped thoroughly. It is essential to have the finished surface flush with pavement. Occasional watering of new sod is necessary if rainfall is insufficient. Shoulders that have become high enough to interfere with drainage need to be corrected. If the sod must be removed below the root line, select topsoil will be placed on the subgrade to speed the growing of new sod. Fertilizer will be applied before final harrowing and smoothing. Appropriate cover-crop seeding will be done if the work is accomplished in the fall. Sod shoulders that have been raised above the pavement grade by frost action will be rolled early in the spring to compact the sod and soil to its original position. Regular mowing of sod shoulders will be accomplished to improve the appearance, help grass spread and reseed, and form mulch from the cuttings.

(4) *Filling and shaping*. Shoulders and roadsides must be kept in good condition through filling and shaping to maintain smooth surfaces.

(a) Earth shoulders. Earth shoulders are particularly subject to rutting and erosion. Periodic maintenance consisting of such operations as filling of ruts and washes and shaping with motor graders are necessary to keep the shoulders in the desired condition.

Earth shoulders will not be worked when they are excessively wet or dry. The suggested operational method is to pull material up to pavement edge and then spread evenly over the entire shoulder. A motor grader can be equipped with an auxiliary blade so that the shaping can be done in one operation. When it is necessary to grade shoulders that have become high, the excess material will be pulled onto the pavement, unsuitable material removed, and the balance hauled to low spots or used to widen fills. When shoulders are graded to proper sections and it is necessary to fill eroded spots, the material will be imported. Sand shoulders on high fills which are subject to wash will be stabilized by blading off 3 or 4 inches of sand, blending and rebuilding with clay, and then sodding or seeding.

(b) Soil-aggregate shoulder. Frequent blading is required to maintain smooth and even surfaces and to prevent water ponding on the pavement or in ruts. This may best be done when the surfaces are damp and pliable. No ridges will be left on shoulders or adjoining pavement after blading. The piling of aggregate on shoulder edges will be avoided. If the material is loose and unstable, binder soil will be added in the amounts required. If shoulders are high, the excess material that is bladed off will be used to fill low spots or widen fills. Soil that has worn, washed, or blown off shoulders will be replaced with the best selected material available. Soil will not be obtained from slopes and grassed ditches of proper cross section, but will be obtained from suitable borrow areas. It is preferable to blade soil-aggregate shoulders in the spring and fall of each year.

c. Bituminous shoulders. Bituminous treated or oiled surfaces will not be maintained by blading. Maintenance and repair methods are described in chapter 3 for the appropriate class of bituminous surface or pavement. Resealing is required to maintain an impervious surface.

6-6. General maintenance

Road intersections and shoulders need to be kept clear of all obstacles to provide an unobstructed view for vehicle traffic and pedestrians.

a. Road intersections. Vision at intersections and railroad crossings will be unobstructed, whether or not traffic is regulated or protected by signs or signals. Signs, poles, shrubs, stockpiles, and temporary structures will be relocated or removed, weeds, cut, and snow removed with this end in mind. Intersections will have minimum sight distances of at least 100 feet in urban areas and 150 feet in rural areas. This may involve flattening or terracing cut slopes and removing other obstructions. Guidance contained in the "Manual of Uniform Traffic Control Devices for Streets and Highways" will be used for appropriate signs, signals, traffic separators, and other traffic control measures.

(1) Paved intersections will be kept free of loose materials by sweeping regularly with heavy-bristled push or power brooms. Accumulated debris will be deposited on low eroded shoulder areas.

(2) To prevent loose aggregate on side roads from being scattered on pavement, the approach area will be stabilized with binder soil or a bituminous treatment applied.

b. Roadside vegetation. Roadside vegetation needs to be controlled predominately for safety concerns, but also for drainage and accessibility considerations.

(1) Weed mowing along roads is not accomplished for the sole purpose of improving appearance. If weeds are allowed to grow high along shoulders, vehicles tend to shy away from the road edge. This results in vehicles remaining in the center of the road and the loss of full use of the pavement. Also, dangerous traffic conditions occur due to the loss of sight distance around curves. Weed cutting in the fall is also necessary in some locations to reduce drifting snow. In mowing and weed cutting, the entire shoulder will be cut. Signs, markers, headwalls, guardrails, and bridge approaches will be kept completely visible, both in front and behind. Brush or shrubs will not be permitted to grow under bridges or at inlets or outlets of drainage structures. The ground under and around timber structures will be kept free of dry brush, weeds, and other flammable materials.

(2) Several documents have guidelines on the eradication of noxious weeds, mowing, disposal of grass, and disking or spraying and burning of roadside vegetation. Grass will be preserved and planted where it assists in preventing soil erosion. Roadside improvement will be directed toward the elimination of harmful and unsightly vegetation and toward encouragement of planting of vegetation beneficial for erosion control and appearance. Shoulders and shallow ditches will be seeded with varieties of low-growing dense grass. Sod or plant vines will be utilized when grass seed will not grow on eroding slopes.

(3) Trees and shrubs will be preserved unless they present a traffic hazard. Overhanging branches will be trimmed to provide a minimum vertical clearance. All unsound and dead limbs overhanging the roadway will be removed. Trees that interfere with visions or side clearance will be trimmed or removed. Dead trees and trees with weakened roots or top support, which might endanger traffic by falling across roadway, will be removed.

Planting of trees and shrubs will be regulated so they will not interfere with reasonable future widening or improvement, maintenance operations, overhead utility lines, vision at intersections, railroad crossing, or inside of curves.

(4) Maintenance materials will be stockpiled at economical and convenient intervals except where the material is secured easily from commercial plants. Stockpiles will be placed and maintained so that they do not constitute a hazard, and will be kept clear of shoulders, ditches, drainage channels, structure openings, and airfield clearance zones. Materials should not be stored where truck loading is required on inside shoulders of curves, near crossings, or on hills where sight distances are short. Stockpiles or pit- or crusher-run materials require careful handling to avoid segregating coarse and fine materials. Where shovels, cranes, or loaders are used in stocking and loading, materials will be spread in layers to prevent segregation.